
BRIEF REMARKS

UPON

Mr. Jacob's Treatise

ON

WHEEL-CARRIAGES.

(Price the sixth Part of Six Shillings.)

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BRIEF REMARKS

U P O N

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SOME
BRIEF REMARKS
UPON
Mr. Jacob's Treatise
ON
WHEEL-CARRIAGES.

CONTAINING

- Chap. I. The Sample.
II. The Magic-Levers.
III. Vis Inertiæ.
IV. Great Stones.
V. The Imaginary Draught-Line.
VI. The Challenge.

By DANIEL BOURN.

Reader, I should not have taken the Pains to write an Answer to Mr. JACOB's Treatise, had it not been manifestly calculated to mislead the Publick with Respect to the Principles and Utility of ROLLING CARRIAGES, which are, at present, on the Eve of being introduced, and duly encouraged.

L O N D O N :

Sold by the AUTHOR, at Mr. Mowbray's, in Long-Acre, and Mr. CROWDER, in Parer-noster Row, with ample Allowance to Bookellers. Where also may be had, BOURN's two former Treatises on Wheel Carriages. Price 1s. 6d. each.

MDCCLXXXIII.



BRIEF REMARKS, &c.

C H A P. I.

THE SAMPLE.

THE numberless errors contained in Mr. Jacob's fix shilling volume, would require an answer (were it merely to touch upon them all) as large as the original. We will therefore thrust the pen into this mass of materials, between the leaves, and where that instrument accidentally opens the piece, draw a fair sample, that he, who may be disposed to become a purchaser, may thereby be apprized of the value of the commodity he is about to obtain.

Mr. Jacob informs us, section 1st, page 23,—“That the friction of a body sledging
“upon the ground, is not annihilated or
“diminished, but its effects only more easily
B “over-

“overcome by the fixing wheels or a rolling
 “body thereto.” A strange paradox this
 is, that the friction should thereby be
 “*more easily overcome*,” and yet not at all
 “*diminished*.” If this were the case, wheels
 would add nothing but weight and cumber-
 someness to the machine; for why are they
 applied, unless it be to take away the *friction*?
 How the *friction* therefore can be “*overcome*,”
 and yet “*not diminished*,” is agreeable to the
 whole production! a piece of unintelligible
stuff, without truth or sense. The fact is, that
 when a set of wheels is put under a sledge,
 the *friction* between the sledge and the ground
 no longer subsists; and consequently, must be
 annihilated, and the *new friction*, created
 between the box or nave and axle-pin, is so
 inconsiderable, as not to be worth mentioning
 in competition with the former.

But the author says, “it is not *annihilated*
 or *diminished*, but *transferred* (see page 23
 and 30, and other places) — “*transferred!*”
 whither for goodness sake? why Mr. Jacob
 tells us in sundry places, that it is “*trans-*
ferred to the nave.” I should be glad to ask
 this ingenious gentleman, whether this
friction might not by the same rule be
transf-

“*transferred to the nave*” of another machine; for instance, from a sledge at London, to the *nave* of a waggon at York? and if “*transferred*,” I judge the whole is “*transferred*,” and indeed so he tells us, see page 25, last line, “but the *whole friction* will “be *transferred* to the axis and the nave.” Now if after being thus *transferred*,” it still retains its vigour or full resistive power (for the ingenious Mr. Jacob *expressly* informs us, that it is “*not diminished*,”) of what service are the wheels? and wherefore is it “*transferred*?” Such unintelligible sophistry is generally best answered merely by being stated; however, Mr. Jacob, for the most part, has generously saved his opponents even this trouble of *stating*, for it is scarcely possible to render some of his contradictions more manifest than they appear in his own words. He informs, in page 23, 1st section, and again in page 46, 11 line, “that the nave *rolls* under “the axle-tree *somewhat* in the same “manner as the wheel rolls over the supporting plane,” that is, the ground. I do not know what he may mean by the word “*somewhat*,” and I ask the gentleman’s *pardon* if I mistake him, but I thought the

nave had *rubbed* or *slid* under the axle-tree and that the face or periphery of the wheel *rolled* upon, or by application, met or embraced the ground or road without rubbing, for these two operations of *rubbing* and *rolling* are so far from being similar, that they are, on the contrary, diametrically opposite; because friction, which is created by *rubbing*, is certainly removed by its natural antidote *rolling*, and therefore, it is apparent that the principles of *rubbing* and *rolling* are most notoriously opposite to each other, notwithstanding that our philosophical mechanic has thought proper to express each of these principles indiscriminately, by their respective terms as if they were synonymous.

He farther informs us in the same page (p. 23) and other places, that "*Friction* "itself being proportional to the weight "or pressure of the incumbent body, it "will remain *exactly the same in all cases.*" According to this doctrine, whether there are *wheels*, or whether there are *no wheels* to convey the weight of the incumbent body (for the proposition includes, "*all cases*") the *friction* "*will remain exactly*
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the same!") The sentence cannot possibly bear any other signification, and therefore all the information we can gather from it, is, that *wheels* would be as *useless*, and afford as little improvement to carriages (were the doctrine true) as our author's desertation upon them.

He then proceeds to inform us, " that " as to the friction of a loaded carriage, it " will be likewise proportional to its weight " whether it press immediately on the " plane supporting it," (for he still persists in his former doctrine, to shew the *inutility* of *wheels*,) " or by the intervention " of the spokes or radii of a wheel: provided " (now mark the proviso)" the axle " or nave be of the *same materials* as the " wheel and its supporting plane, that is, " (says he) if the asperity of the surfaces " be equal." How edifying and uncommon, gentle reader, is this illustration of *friction*. For who would have thought of attributing to the axle and nave that kind of *asperity* which our author here mentions? He first tells us that the *friction will remain exactly the same in all cases*; and then he cunningly devises *such a case* as no other man

man but *such* a *genius* as himself would ever have conceived. For “*as the wheel,*” (or rather its surface) “*and its supporting plane,*” (the road) consist of very different *materials* (viz. the one of iron, and the other generally of *gravel*) so our author, in the redundancy of his invention, is pleased to suppose an “*axle or nave,*” meaning rather, I presume, (to render the opposition of his comparison more complete) an “*axle and nave,* as corresponding parts, made of *the same materials,*” as the surfaces of the wheel and the supporting plane before mentioned; viz. an “*axle,*” of iron, and a “*nave*” of gravel, that “*the asperity of the surfaces,*” (compared in this notable proviso) *may be equal!*” Mr. Jacob would have approached nearer *the truth* (though we should not have had much more occasion to thank him for the *information*, had he told us, that the *friction* of the parts in action is in *proportion* (not, as he says, to the *weight*, but) to the quantity of the grease applied; for, certainly, there may be a very great *friction*, where there is but a *light weight*, and a small *friction*, where there is a *great weight*
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in proportion to the *glibness*, or slipperiness (and the contrary) of the parts that slide. Therefore, the author's assertion, is not true, "that the *friction* is proportional to "the weight or *pressure* of the *incumbent* "body;" and he is still much more mistaken in asserting, in the same sentence, that, "*it will remain exactly the same in all cases;*" how unhappy is our author in his comparisons, as well as assertions! And with how much assurance does he broach them to the world! As all these absurdities are contained in little more than one page, I trust it will be admitted, that this sample has been fairly drawn, and, if the reader will be at the pains to examine, he will find, that almost every page of this elaborate production is filled with such like trash. I shall therefore hasten to another argument, in which our author seems to have taken uncommon pains, and to have lavished upon it the whole force of his mechanical abilities; and though the advocates for high wheel - carriages very strenuously advance, that the spoke of a wheel acts in the capacity of a single lever to assist draught, yet this author, and he alone, with a sagacity peculiar to himself, has bestowed

flowed upon it the high privilege of becoming, from henceforth, a double lever, which see in the subsequent chapter.

CHAP.

C H A P. II.

CONCERNING THE

M A G I C - L E V E R S.

IN part the second, section 4th and 5th, and onward, Mr. Jacob informs us, that the spoke of a wheel not only acts as a single lever in obviating (by which word he must mean agreeably to other places, either *overcoming* or *transferring*) the friction at the foot or foal of the wheel, but it acts as a double lever, in *overcoming* at the same time, that at the nave. He says, in its first or single capacity (see page 38, it acts as a lever, "to *overcome*," (perhaps it should be *to transfer*, for our author sometimes forgets himself, "the friction of the periphery " against the plane of its support," which friction, he says, will be about one third of the weight that presses thereupon; (great indeed !) yet, in page 25th, first and last line,

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he calls it "*little or no friction at all*;" but I shall wink at this little inconsistency, for it would be endless to take particular notice of all the inconsistencies of this nature, which are to be found in this voluminous author, as they occur so very frequently throughout his work. This first or *single lever*, then overcomes the "*little or no friction at all*," at the foot of the wheel. The other, or second, he employs in "*overcoming*," yet not lessening, "*annihilating or diminishing*" that *friction*, the *whole* of which friction had been "*transferred*," (tho' some part still remained) from the foot, soal, or *periphery* of the wheel, and is now arrived at the *nave*. Here it is proper for the reader to *wink* again, or he will see some inconsistencies that may urge him to laugh; let us, therefore, go gravely on. In this manner doth our very ingenious author, Mr. Jacob, contrive to make one *simple spoke* of a wheel perform the office of *two levers*: and as he is a person fond of repetition, and tautology, I shall again state the use of these levers to the reader.

Know

Know then, that the *first* lever overcomes the friction at the *foot of the wheel*, "the *whole*," (see page 25, last line) of which *friction* is "*transferred to the nave*," and yet, some part of this very friction remains behind, or else the first lever would be unemployed. This is a great mystery, reader, and I would have thee conceive it as such; and, in order to the clearer unfolding it, I should be glad to ask the gentleman, whether the *friction* was "*transferred*," before the action of this lever? or whether the lever is constantly *transferring* it by its continued agency? or whether, as soon as it begins to operate, it *transfers* it at one jerk; and, afterwards, remains idle and unemployed? or, lastly, whether it may not be engaged in overcoming that *friction*, which *remains* after it had been *wholly transferred*; (compare page 38, third line, with page 25, first and last line.

Let us now come to the second lever of the spoke, the office of which it is to "*over-*

come," (for he will not allow that it "*diminishes*,") the friction that has been manufactured and transmitted, or in his own words, "*transferred to the nave*." This second lever, then, seems to me to be the more important of the two; for *this* entirely overcomes the friction which *the other* seems only to *transfer*; and, therefore, in my weak opinion, the *second* ought to be larger and stronger than the *first*: and so, perhaps, it may, for the ingenious author, in conformity to many great writers, has left something for the employment of his readers own abilities to work upon; he has, consequently, nowhere informed us of the exact dimensions of either of these twin-levers, contained in this one spoke; but we may fairly infer, that the second lever, having more work to do, must, on that account, adopt to its service a much greater share of the timber of the spoke (in proportion to its activity) than the first. Be this as it will, our author has, at least, equipt these levers secundum artem; he has given to each a fulcrum, and two arms, a longer extended one, and a shorter; although the shorter one is so very short, it would puzzle the ablest mathematician

thematician to form an adequate conception of it ; the ten thousandth part of an hairs breadth, would be an infinite length to it ; a length, however, we are to suppose it has ; and that each lever is in propria persona, accoutred and situated ready and prompt for action ; wherefore, our last and material concern, which remains to be investigated, is, how each lever performs the office assigned it ? for we cannot suppose, but that this great mechanic, who out of the store-house of his understanding brought forth such an ingenious device (a device that has hitherto lain hidden from the human mind, and which, perhaps, might have lain dormant for ages to come, but, for his Newtonian genius;) it cannot, I say, be supposed, but that so notable an author must have clearly assigned the peculiar work and office to each of his supposed levers, and also demonstrated, that the same will be most effectually executed by them, since he has filled near one third of his book with this extraordinary discovery. In order, therefore to comprehend our author's philosophy, with greater perspicuity, we will just dip into the essential qualifications of a *lever*.

Know

Know then, reader, that a *lever* absolutely and necessarily turns upon its fulcrum, just as a scale-beam does upon its centre. The fulcrum is not only the point or centre of support, and the centre of power, but it is also the centre of motion, to every point or part of that lever, about which the arms circularly swing. Now this unparalleled author has made *two undivided levers* out of *one* spoke, the *fulcra*, or (rather in the English stile) the *fulcrums* of which are placed, he says, in page 43 "*at*," but by his description in other parts of his book, he must rather mean *near* to each extremity of the said spoke; (consequently there must be twenty-four levers in the twelve spokes of a wheel.) The longer arm of each lever, if they are both of equal dimensions (but of this he has not deigned to give us an account) I say the longer arm of each lever must meet the arm of its fellow-lever, in the middle of the spoke; and they are there knit together by that attraction of cohesion, that was imparted to them in their growth in the woods. Now, how these levers can turn, or swing, or describe circles, or parts, or segments of circles

cles, each round its respective fulcrum, whilst wedded in union, by the nuptial bands of nature, is to me *such* a mystery, that I am obliged to acknowledge myself totally unequal to the task of unfolding! and must, therefore, refer the reader to the author himself, for a solution. I have hitherto simply entertained an opinion, that a spoke was only driven into the nave or stock, merely for the purpose of marching round the axle, and in its turn, supporting the load, while proceeding on its journey. But what will not unbounded capacity find out! This gentleman, in the plenitude of his penetration, has discovered, that this self same spoke not only revolves round the axle-tree of the carriage, but that it acts in the double capacity of two levers, at the same time; and, that these levers turn or swing each upon its respective fulcrum! O GREAT AND MARVELOUS MECHANIC! who by such astonishing exertion of thy magical ability, canst impart at the same instant of time, *three* different motions in *three* different directions to *one solid stick of wood!* May thy name be celebrated by the
society

society in the Strand, and highly applauded by all the coach-makers in Long-Acre. *

C H A P. III.

VIS INERTIÆ.

A QUAIN**T** bugbear, or hindrance to the motion of carriages, mentioned by Mr. Jacob, is *vis inertia* (power of sluggishness :) this hindrance our author mentions, page 55, line 4th, as incomparably greater than “the rubbing between the axle and box,” so that this is by far a more terrible adversary than friction, and in page 66, line 5th, he says, “in the draught of carriages along horizontal planes, the moving power or team acts almost solely against the *vis inertia* of the load,” and yet in page 3d, he says, “the leg of a fly moves, or overcomes the *vis inertia* of the whole globe of the earth.” I must confess, that if I had written

* Mr. Jacob seems not to have understood, or, at least, not to have availed himself of the ingenuity of his own device: for he mentions but two levers in a spoke; and yet, he argues that all those marvelous teeth, on which a spoke bears, both those at the head, and those at the foot, give each a fulcrum to the spoke: and, surely, there must be as many levers as fulcrums; which therefore, instead of two levers, must produce two thousand, or rather two thousand million in one spoke, O Jacob! Jacobus *crispius* *est* *tui*.

written his treatise, I should not have thought of so whimsical an hinderance. At the first onset to motion, indeed, in the morning, or if the cattle stop to perform any of the offices of nature, this naughty sprite *vis inertia*, hangs a little heavy behind the waggon; but as soon as the cattle give one good pull, away he slinks off, and a very active handy spirit, called *momentum*, steps in, and takes his place, whose friendly assistance is exactly equipollent to the hang-back mischief of his opponent.

C H A P. IV.

G R E A T S T O N E S.

AYET further obstruction to the motion of wheel carriages, which our author, in his great wisdom, has discovered, is *great stones*, or such as stand upright, and make an open angle against the face of the wheel, at its approach to them. Thus, as if wheels were always engaged against stone walls, and church steeples, objections are made, where there really are none; or where, at least, they

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but

but seldom exist ; for a person might follow a waggon from London to York, and meet with very few, if any, of these kind of obstacles : but our author enlarges upon them, because they seem to militate against little wheels, to which he appears to be no friend ; and though he allows that little wheels will run up a hill, see page 67, easier than great wheels, yet not so freely down a hill, or on a plane, or over a stone ; and in order to imprint this more effectually, in his readers mind, he has given us a print, see page 61, in his book of a stone, or block, before a great wheel, and another of the same height before a little wheel ; and some of his observations thereupon I allow to be just.

But I will take the liberty to ask Mr. Jacob a question or two. Pray, Sir, tell me then plainly, Was it ignorance, or was it some other motive that led you to draw or pull *both these* wheels indiscriminately over the obstacle, by a parallel line ? did you think the *little wheel* was to be drawn over this mighty stone by a *little horse* (or perhaps a cat) but the great wheel by a full
fized

sized beast? or is it possible to draw a little wheel over a stone, by a common sized horse, otherwise than by an oblique line? or can an oblique line of draught be obtained, otherwise than by lowering the size of the wheel? and did not you know, that by the aid of the *obliquity of the traction-line*, the little wheel would have rolled over this stone, or any common sized stone *as easily as* the great wheel? These queries, I must beg leave likewise to refer to Mr. Martin, and Mr. Ferguson, of Fleet-street, who on this subject are constantly misleading their auditors, for though I know they are very sensible gentlemen, and that their lectures are well adapted for public improvement, yet, with respect to wheel-carriages, they are greatly deficient: I would engage to take their own apparatus, and show them an experiment, which would make them say, *pudet me rei*. But by this time, I may be asked what is the genuine material hinderance to the progression of a loaded waggon? I answer, every thing which Mr. Jacob seems to have forgot, or he never would have plagued his readers

with his visionary phantoms ; in a word, it is the unevenness or badness of the path:

Go with me into yonder road, view that bed of loose sand, or those layers of mud, dirt, and clay: see the cattle stretching every nerve to wind their passage through them, and the wheels thickened with loads of mire: view that parish-road filled with holes, or sloughs, or hillocks and rutts: let us now view this more agreeable turnpike-road; and, yet, even here, you will find that these less degrees of loose dirt, and mangled materials, make a very formidable obstruction to draught: consider what power is requisite to lift six tons up the circular, or cycloidal faces of those short ascents worn thus by wheels into scollops, before the carriage attains their summits: and consider with what vast gravitating pressure, these wheels are bound to the face of the road, and you will be at no loss to account for the difficulty of the traction. Here is some very fine even road, see! the chains are slack, and one horse draws the whole load. Now tell me, reader, is it an accidental *stone*? or is it *friction*? or is it the *vis inertiae*?
is

is it such bugbear fooleries as these? or is it not rather the nature and face of the road, that effect these mighty differences! which nothing but broad smooth faced rollers can cure or render smooth and firm.

C H A P. V.

O N T H E

IMAGINARY DRAUGHT-LINE.

IN page 75, our author is speaking of the manner of loading waggons by the country people; and mentions Mr. Bourn, as approving of their method of laying a greater share of the load upon the fore wheels: being thus loaded, "he," (Mr. Bourn,) says the author, "imputes the greater facility of draught in this case, to the obliquity of an imaginary draught-line, between the centre of the fore wheels, and the hind ones." Now, Mr. Bourn, does not *impute it* to "*an imaginary,*" but a *real* "*draught-line,*"
(the

(the shafts) subsisting between the fore wheels and cattle ; but even, if Mr. Bourn had *imputed it* in the manner he mentions ; dare he affirm, that the tail-pole of a waggon is an "*imaginary line*," and not a visible palpable substance ? Certainly, it has all the properties attributed by Lilly's Grammar, to a noun-substantive : It may be both seen, felt, heard, and understood ; and, I fancy, was the pericranium of this surprizing writer, impelled against it, with a percussive force, he would thereby be convinced, it was not so very *imaginary*.

It does not seem consonant to this author's purpose, were he capable of it, to have shewn the different effects of an *oblique* and *parallel draught-line* upon carriages. He tenderly touches the subject, indeed, in his ninth page, where he observes, "that though an
 "oblique line of traction enables an horse
 "to exert a greater force, yet this force
 "cannot be kept up, or continued without a
 "proportionable fatigue to the animal." And, for the truth of this assertion, we must rely on the writers ipse dixit, for he assigns no other authority for it. In conformity to
 such

such kind of argument, I will venture to give the reader my own ipse dixi, which is, that an *oblique line of draught* not only enables the beast to exert its strength with greater force, and to continue to do so; but it is also the best mode of conveying real power to the load, by which the same is to be moved, or advanced over those obstructions, and short elevations that lie in the path of the wheel. For a carriage wants very little power to draw or move it, except when the load is *rising* or increasing its distance from the centre of the earth; and, in *this case*, let the intelligent reader judge, whether an *oblique draught-line*, which *elevates*, or a mere parallel draught-line, which only tugs the weight with an *horizontal impulse against* the obstruction, is likely to perform the service required with most advantage? Strange, wonderfully strange! therefore, is the doctrine of our author, that “an oblique line of traction,” which, as he acknowledges, “enables an horse to exert a greater force,” and, by which, consequently his strength is applied to the most advantage, “cannot be kept up without a proportional fatigue to the animal.” And that
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the continuance of a means which is so advantageous, as to enable an horse to exert *a greater force*, should, notwithstanding, be more fatiguing to the animal, than the continuance of that means, which, confessedly, renders the beast *less* powerful, and must, consequently, require *more of his exertion*! Let us merely, for the sake of altering the argument, throw it into a short syllogism, thus, —

An oblique draught-line enables an horse to exert his strength with the greatest ease.

The easiest means is the least fatiguing.

Ergo,

To continue to exert strength, by the easiest means is the most fatiguing.

Such is our author's mode of arguing, which surely requires no further reply. If any of my readers desire to see this subject, handled more at large, I must beg leave to refer them to a treatise I published some-time ago. The author also tells us, that high wheels may be too high, and low wheels too low; but he has very prudently omitted to inform us, how, wherefore, or in what degree; for he no where tells us what
height

height he would recommend. He has also left undetermined, a variety of other very important things, which, if properly explained, might have been of real service; but, instead of these necessary topics, he has stuffed his book with a long, tedious, unintelligible, * uninteresting dissertation, about *friction*, and a brace of twin-levers, that are *imaginary* to a witness; *like the ghostly offspring of a bewildered fancy.*

* A specimen of our author's frivolousness and obscurity in his language, and mode of arguing; I have taken from page 7, the words are, "It may suffice our present purpose to observe, that the exertion of both these powers being limited by the size, weight, and structure of the animal. The maximum, or greatest velocity to which it can bring the motion of the carriage on a horizontal plane, can never be greater than that of its own pace, or constant local motion, as this pace is again limited by the structure, weight and muscular elasticity or agility of the animal: the velocity of the carriage will always be determined by the velocity with which the animal is capable of acting constantly against the obstacles and impediments once given the carriage."

Which rendered into plain English, may stand thus. Suffice it to observe, that the horses cannot go faster than the carriage, nor the carriage than the horses, except on an inclined plane, and that the speed of both is in proportion to the strength of the cattle. Reader, is not this both wonderful and instructive? sure, such a heap of despicable stuff was never broached to the world before.

C H A P. VI.

T H E C H A L L E N G E :

Addressed to a Committee of Mechanics.

HAVING now done with our author, and having also, in some degree, I trust, exploded a few, and, indeed, but a few, of the many errors contained in his book; that the reader, by this sample, may be warned to avoid the rest; I am not unhappy in having this opportunity of renewing a challenge, which I formerly made to a certain eminent society; I do not mean to the society in general, in the Strand (for which, on account of many very worthy members, I have the highest regard, as well as for the institution itself) but I address myself, at present, to a certain class of its members, who call themselves mechanics, and who, for the most part, form the bulk of the committee of that denomination. And, I challenge any one of them singly, or the whole, jointly, to answer the arguments contained in my former treatise on wheel-carriages, and they may, if they please, employ
Mr.

Mr. Martin, or Mr. Ferguson (with whose lectures and experiments on this subject, I am well acquainted) as assisting council to answer the said arguments: for, nothing has appeared to controvert the principles there laid down, except this notable performance of Mr. Jacob's; and, as I apprehend, that he is one of their fraternity, I have looked upon him as the mouth-piece and champion of the committee; but, finding him a very weak adversary, and unequal to the combat, I desire he may be laid aside as incompetent, and that you proceed to a fresh choice. My answer to him, indeed, is but *short*, yet, I flatter myself, it is sufficiently *long* to demonstrate his impotence, and to justify your rejecting him as your champion, to oppose those principles which I have advanced on the subject of wheel-carriages. The principal topics in dispute, are, First, That the spokes of a wheel *do not* act as levers in assisting the progress of a carriage. Secondly, That an *oblique draught-line*, is preferable to a parallel one, and that a two foot wheel, does not give it too much *obliquity*. Thirdly, That cylindrical rollers, may be applied with great advantage to carriages, and that they

will go *as easy*, even in the present condition of the roads, as the wheels now generally used. Fourthly, That a general use of such rollers, would render the high roads *smooth, firm, and even*, as a well *rolled* terrace, or gravel walk; and would, consequently, preserve the materials, so as to occasion, even in that article alone, the saving of a prodigious annual expence to the nation, especially, as materials are growing scarce, by the continual gleaning the circumjacent lands of their stores of stone and gravel; whereas, by the use of these smooth-faced-rollers, any common materials, provided they have but a tolerable consistency, will answer the purpose; for, when once they have been consolidated by these rollers, they will not be so liable to become soft and spongy, even under long continued showers as at present; but will grow more and more firm and hard, neither will they be liable to be torn into ruts, and pulverized. Fifthly, The more these rollers are burdened, the more profitable will be the effect. And, Lastly, That when rollers come into general use, one horse will draw as much as two do now.

To

To these points, which I have openly defended, in the face of the world, I shall expect your attentive consideration and reply ; and the public will, probably, have the same expectation, as the topics are of a very *weighty* as well as *general* concern : and, though prejudices in mechanics may be nearly as difficult to root out as those of religion, or politics; yet your contempt or silence, in this affair, will not serve your purpose, neither will it bury the consequence of such just and rational principles in oblivion, nor screen the character you may wish to support, as men of more able and superior talents, either in your separate, or joint capacity. The Infant you had condemned, and nearly slain, is still living, and will soon break forth with augmented vigour and gigantic manliness. And as nine inch wheels, which received their origin from the same fountain, have surprizingly increased, and are now become common, so I will venture to affirm, that this my new, or second production, will also gain acceptance with mankind, and in like manner with, or without your approbation (though your friendly concurrence is undoubtedly more desirable) will speedily increase, so as not only

only to become far more numerous and extensive; but likewise so as to demonstrate their beneficial effects, in the most conspicuous manner. There is a gentleman, who with a penetrating eye, sees the full scope and weight of the argument before us; whom neither the cavils and ferocity of hot-headed bigots on one hand, nor the consideration of a weighty expence on the other, can deter from pursuing, with indefatigable ardour, perseverance and assiduity, what he esteems a momentous national advantage; and who, if he meets with no other recompence, is sure not only to enjoy that, of the retrospective approbation of his own generous heart, but also the grateful thanks of every friend to VIRTUOUS ATCHIEVMENTS, *for wisdom is justified of her children*: such men are the glory of a nation.

Seeing by chance a letter in the St. James's Chronicle, of Dec. 30. 1772. to Jan. 2d, 1773, much to the purpose of the subject before us, I have taken the liberty to subjoin it.

To the Printer of the St. J. CHRONICLE.

S I R,

Jan. 2d, 1773.

HAVING frequent opportunities of travelling all the different roads from fifteen to twenty miles round Northampton; it is with particular pleasure I observe the good effects of the rolling machines on the turnpike-road to Stony-Stratford, and from thence on the cross road to Dunfanger.

For

For this important improvement the publick is indebted to the ingenious, and truly publick-spirited Mr. Sharp *, who has, I am informed, spared neither labour nor expence in rendering these machines complete. So interesting a scheme merits all possible encouragement, and will soon, it is to be hoped, engage the attention of an august assembly.

These rollers are true cylinders of cast iron, placed under the body of the cart or waggon, each of which is sixteen inches broad running abreast, or parallel with each other, rolling or smoothing a perfect flat surface thirty two inches broad. † Hence they possess every advantage of levelling the ruts, cleaning away mud and dirt, and cementing the gravel: So that whoever compares those smoothing and cementing rollers, with other wheels, which grind and plough up the roads, will be at no loss in determining to which he ought to give the preference.

The present ruinous state of the roads, notwithstanding the enormous annual expence of keeping them in order, fully evinces the destructive tendency of the ordinary wheels, and at the same time points out the utility of the new-invented machines, the rolling waggons, and the necessity of their being brought into general use for all heavy carriages. The excellence of these machines is not founded merely on speculation, but on repeated experiment, the surest way to useful knowledge. But as new improvements are too often opposed, merely because they are new, it is no wonder that objections have already been started against the rolling carriages. Some affirm that they must prove injurious by destroying the convexity of the roads; others alledge that they require a stronger draught to overcome resistances than high wheels, and that consequently they will want a greater number of horses to draw the same weight. If the main end of making the roads convex is to prevent water stagnating on the surface, I would ask whether it is found to answer this purpose? or whether the intention is not defeated by the deep ruts occasioned by the present destructive wheels? Now if a flat smooth road is capable of being drained by proper sluices and
ditches

* *Of Lladenhall-Street, London.*

† *See Mr. Sharp's Description.*

ditches (as doubtless it may) it will be found to be much more commodious for all sorts of carriages than a convex road; and should the old Roman roads which sustained carriages amazingly heavy laden, be found on enquiry to have been flat, not convex, and the wheels at the same time low, the two grand objections to the rolling machine will vanish. Yet let us suppose, for a moment, that a waggon with rollers will require an additional horse, or even two (which however Mr. Sharp, ‡ by very cogent reasons, endeavours to disallow) yet still the far superior advantages accruing to the roads both for carriages and saddle horses, will greatly over-balance that inconvenience. Moreover, his laudable scheme for introducing oxen into the draft instead of horses, is for obvious reasons particularly seasonable at this juncture, and well deserving of imitation.

In justice, therefore, to Mr. Sharp, I have thrown together these loose hints on an improvement which seems highly interesting to the commercial part of these kingdoms, and to the public in general, hoping they will not neglect to avail themselves of the discovery, and that the worthy author of the proposed improvements will, after a candid trial, have the satisfaction of seeing them carried fully into execution, so as at length to triumph over all prejudice, ignorance, and opposition.

Your's, &c.

Northampton, Dec. 15.

A. F.

‡ And is prepared to demonstrate their utility by experiments, or by the carriages themselves, *ibid.*

N. B. There are other Letters in town to the same purport; but it is unnecessary to add more to attest a thing so demonstrable, and self evident, as the utility of rollers; which doubtlessly will continue to flourish, and roll, when narrow wheels, ignorance, and Jacob, will be sunk in the dirt.

11 JUN 62